Aug. 27, 1946. F. G. BUHRENDORF 2,406,348

SECRET TELEPHONY

Filed July 26, 1941 3 Sheets-Sheet 1

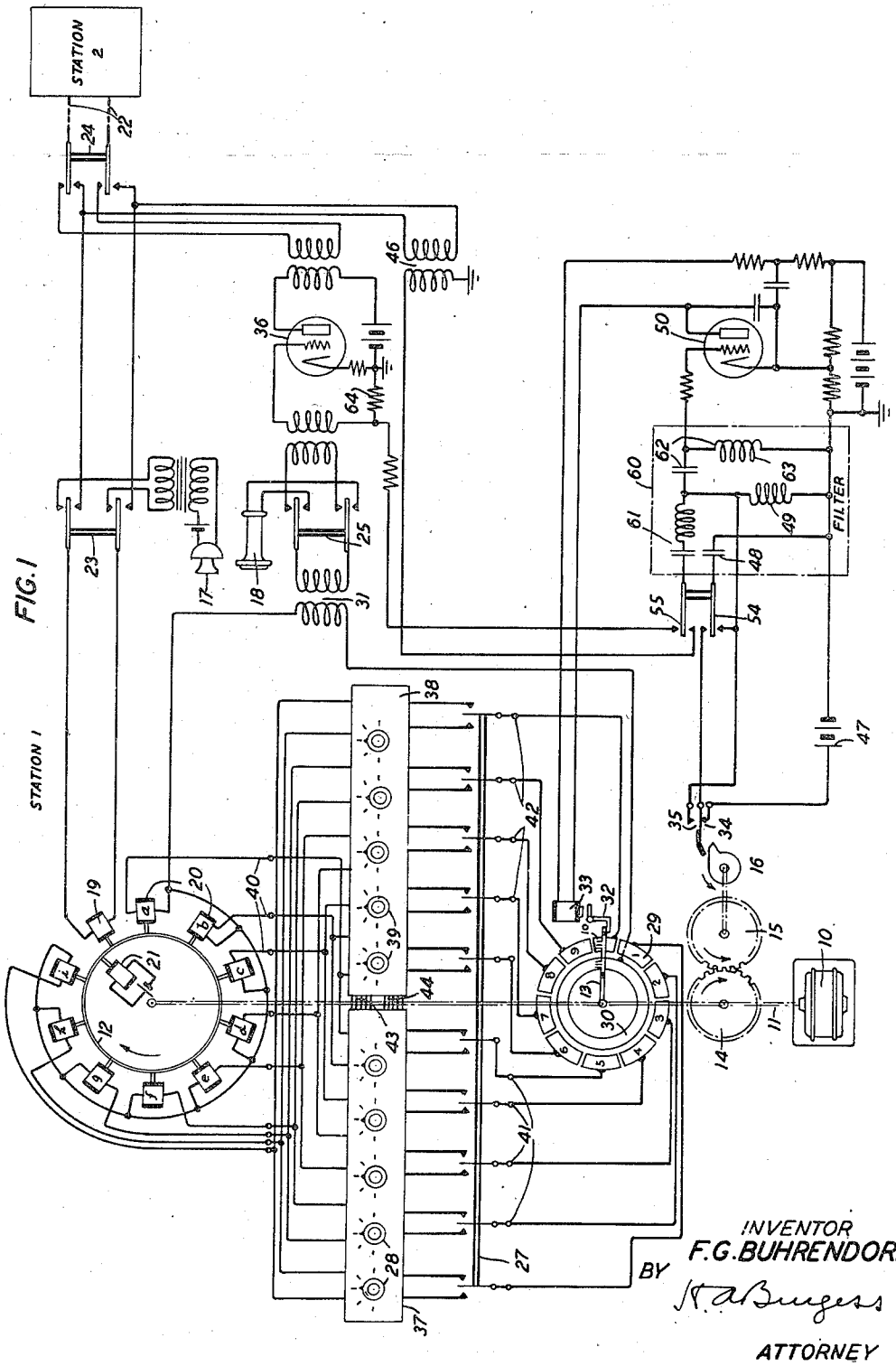

FIG. 1

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SECRET TELEPHONY

Filed July 26, 1941 3 Sheets-Sheet 2

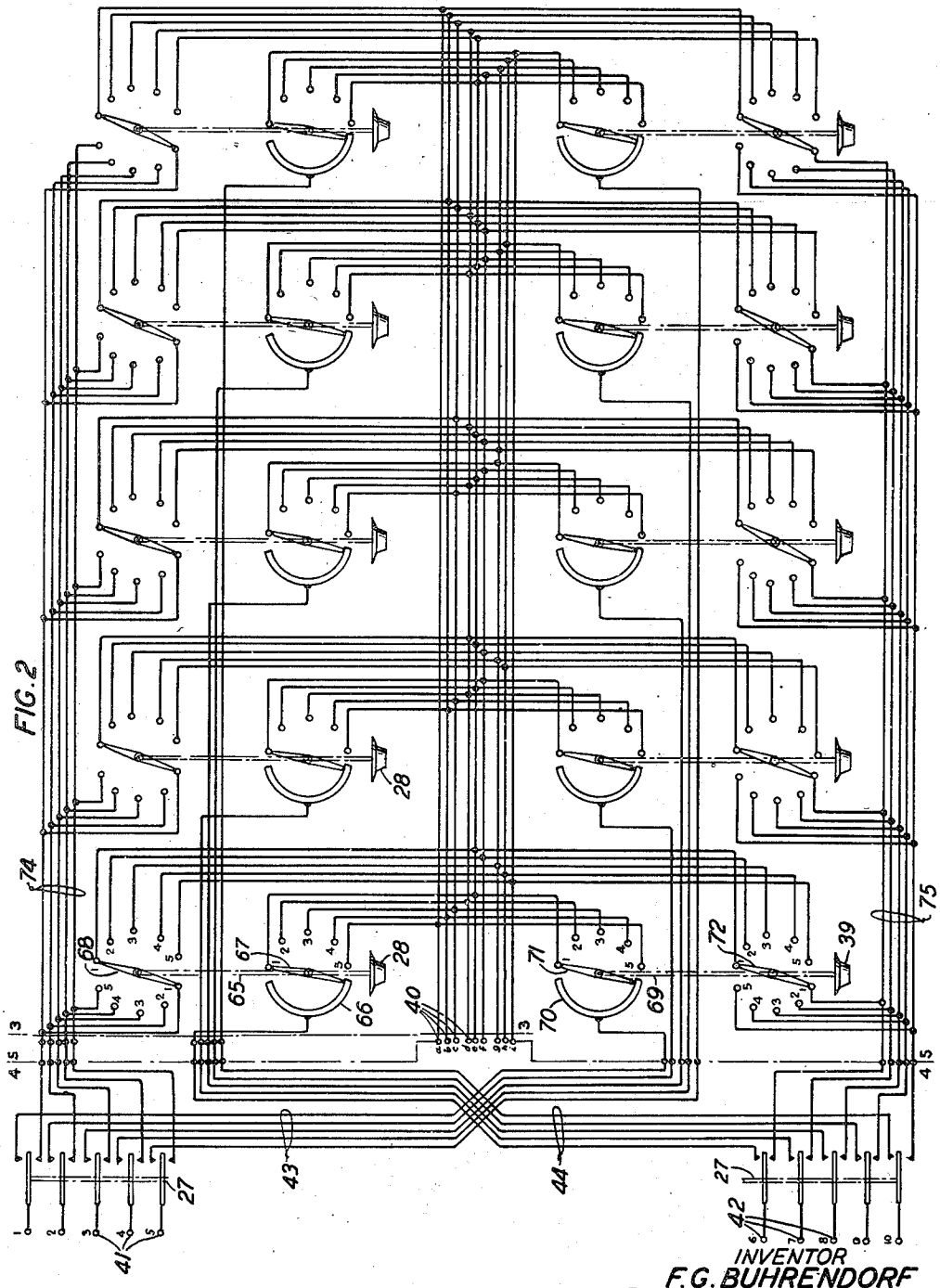

FIG. 2

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SECRET TELEPHONY

Filed July 26, 1941 3 Sheets-Sheet 3

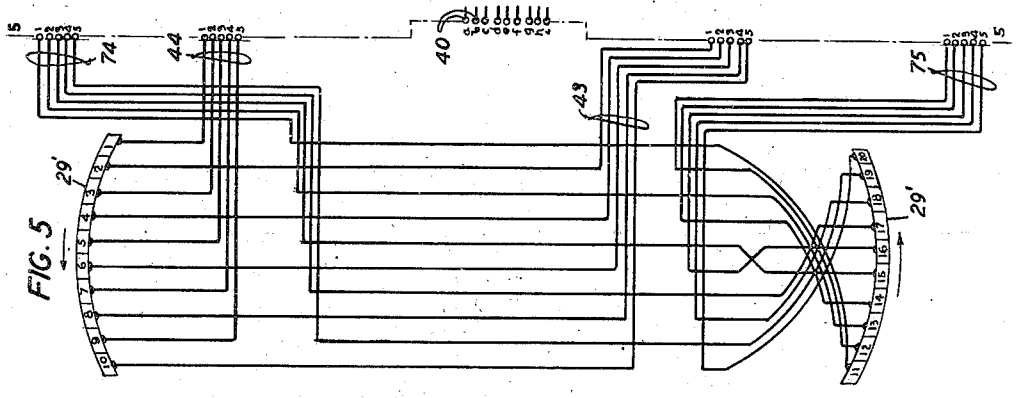

FIG. 5

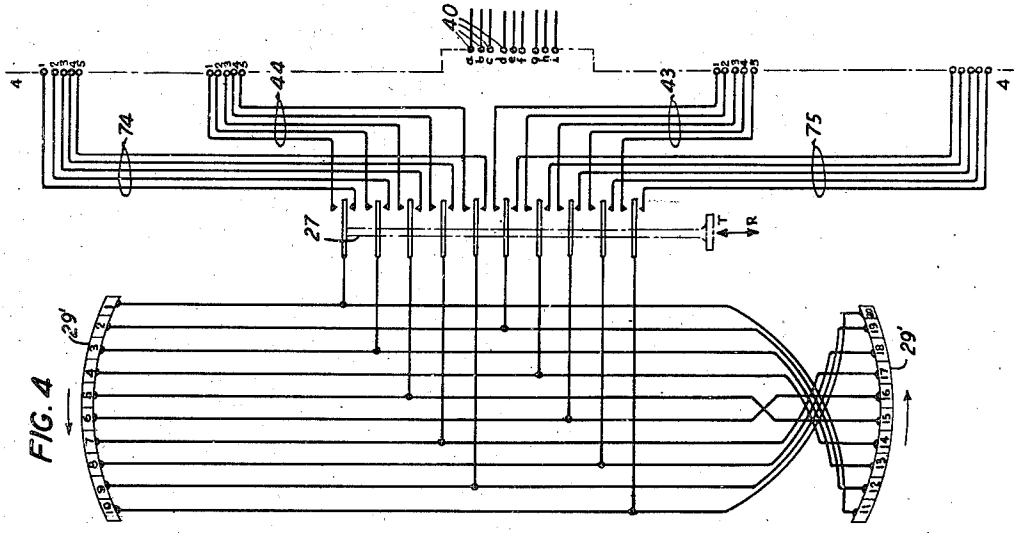

FIG. 4

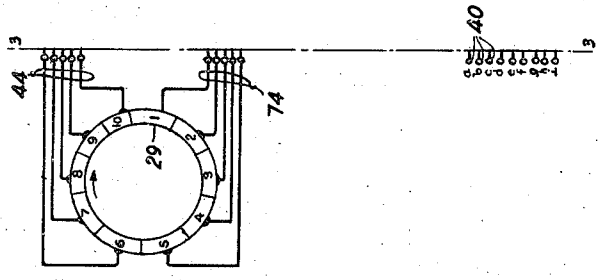

FIG. 3

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Patented Aug. 27, 1946 2,406,348

UNITED STATES PATENT OFFICE

2,406,348

SECRET TELEPHONY

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Application July 26, 1941, Serial No. 404,111

20 Claims. (Cl. 179—1.5)

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The present invention relates to signaling with privacy. The invention relates especially to a type of privacy signaling that is suitable for telephony although it is capable of use with other kinds of signals.

The invention has for an object an increase in the degree of privacy realizable in the transmission of speech or other signals.

It has been proposed to record speech on a magnetic tape or wire and transmit the recorded speech in short segments out of their normal order of occurrence to render reception difficult. The recorded speech may, for example, be broken up and sent in changed order by a timing device such as a rotary distributor.

The present invention provides for increasing the difficulty of deciphering the message by use of a plurality of codes or schemes of rearranging the speech segments, such that the code schemes are used in rapid sequence. While the invention is capable of use with several codes entering into the scheme or pattern, there is a practical limit in any type of signaling on account of the increased complexity of the apparatus and increased manipulation. In the specific embodiments to be disclosed herein, two codes are used in each case, to illustrate the principle. The codes to be used at a particular time are agreed upon between sender and receiver and the codes, or either of them, may be changed from time to time.

The nature of the invention and its objects and features will appear more fully from the detailed description to follow, taken in conjunction with the accompanying drawings in which:

Fig. 1 is a simplified schematic circuit diagram of a complete two-way system comprising two stations in accordance with the invention;

Fig. 2 shows the wiring plan for the coding and decoding circuits of such system; and

Figs. 3, 4, and 5 show modifications that may be made in the circuit of Fig. 2 by substitution at the left along the line 3—3, 4—4 or 5—5, respectively.

Reference will first be made to Fig. 1 which except for the double code feature is similar to Fig. 1 of my application Serial No. 401,908, filed July 11, 1941.

Referring to Fig. 1, a constant speed motor 10 of suitable type drives a shaft 11 which is shown as driving magnetic tape 12 mounted on the rim of a suitable disc, brush arm 13 rotatable over the segments of commutator 29, and a gear train 14, 15 driving a contact making cam 16. The system is arranged to transmit with privacy when speech is spoken into the transmitter 17, under certain circuit conditions to be described, and to receive with privacy in receiver 18. The transmission and reception of the privacy waves take place

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over the line 22 shown interconnecting the terminal stations 1 and 2.

A number of two-position switches are illustrated at 23, 24, 25, 27, 54 and 55. These switches may, if preferred, be ganged together or they may be in the form of relays operated by a single push-button. These switches are all assumed to be operated to their upper positions in the figure (and switch 27 to the right) when speech is to be transmitted and to be operated to their lower or opposite position when speech is to be received. Such switches are commonly referred to as push-to-talk switches and may conveniently be retracted to their receiving positions by springs (not shown), the receiving position in such case being considered normal. The circuit of Fig. 1 will first be described for the transmitting condition, so that switches 23 to 27, 54 and 55 are considered thrown to their upper or talking positions.

The tape 12 is assumed to be rotating in a clockwise direction at constant speed. Located around the tape are a recording magnet 19 and nine reproducer magnets 20 spaced at equal intervals along the tape. There is also an eraser magnet 21 supplied with direct current from the battery shown.

When speech is spoken into the transmitter 17, the speech is recorded on tape 12 at 19 and the record in passing the reproducers 20 generates corresponding electromotive forces in their windings. The terminals of these windings are multiple-connected through two sets of code switches 37, 38 and thence through contacts of transmit-receive switch 27 to segments of the commutator ring 29. It will be noted that nine terminals from the nine reproducer magnets are shown at 40 and that ten terminals are shown at 41, 42 leading to the ten commutator segments. The code switches 37 and 38 and transmit-receive switch 27 are interposed between terminals 40 and 41, 42. Different interconnecting arrangements are denoted in the subsequent figures for giving different types of coding and decoding. Fig. 1 shows how these arrangements may be fitted into the system. The wiring within the boxes 37 and 38 will be described in detail in connection with subsequent figures. It is evident from Fig. 1, however, that the reproducers 20 may be connected in a number of different ways to the commutator segments of ring 29. Brush arm 13 carries brushes bridging across from segmented ring 29 to solid ring 30, the latter being connected to one terminal of winding of speech coil 31, the opposite terminal being common to one terminal of each of the reproducer magnets 20.

It will be seen, therefore, that as the brush arm 13 rotates and sweeps the brush over the segments of the commutator, different reproducers 20 are connected to the speech coil 31 in sequence, and each sequence is at any given time

determined by the setting of the respective code switches 37, 38. In this way it is arranged that the currents transmitted through coil 31 represent fragments of the recorded speech picked up in sequences different from the sequence in which they were recorded. Moreover, these sequences are varied from time to time by changing the settings of the code switches 28 and 39 in boxes 37 and 38. The general method of transmitting fragments of speech out of their normal sequence and of changing the code is more fully disclosed in a copending application of J. C. Steinberg, Serial No. 401,897, filed July 11, 1941.

The speech waves occurring out of their normal order in coil 31 are transmitted through switches 25 and 24 and amplifier 36 to the outgoing line 22. The brush arm 13 frictionally engages the shaft 11 by suitable friction clutch mechanism so that when the brush is released by latch 32 it rotates with the shaft 11 but can be held stationary by latch 32 while shaft 11 continues to rotate. Latch 32 is released by tripping magnet 33 when energized from tube 50 under control of cam 16 and contacts 34 and 35 when the station is transmitting or under the control of similar impulses received over the line from a distant station through coil 46 and filter 60 when the station shown is receiving.

The gear train 14, 15 drives the cam 16 at a slightly slower rotational speed than shaft 11. For example, the gear 14 may have seventy-four teeth and the gear 15 seventy-five teeth. This feature is disclosed and claimed in the coopending application of W. A. MacNair, Serial No. 414,054, filed October 8, 1941.

Assuming that the arm 13 is stopped against latch 32 and that the cam 16 is about to move the contact spring upward to close contact 35, this contact will, then, be closed and connect condenser 48 through upper contact of spring 54 across inductance 49. The condenser, which has previously been charged to the full potential of battery 47 through contact 34, now discharged suddenly through the inductance 49, causing a highly damped wave of 2,000 cycles per second frequency to be generated in the filter 60. One series tuned branch 61 of the filter transfers some of this 2,000-cycle voltage to the input of tube 36 across resistor 64, and the other series tuned branch 62 transfers some of the 2,000-cycle voltage to the input of tube 50, the grid circuit being connected across the inductance 63. Tube 50, which is a gas-filled tube, breaks down and sends a fairly heavy current through release magnet 33, releasing the brush 13. At the same time, the brush at the distant station is released by the pulse sent over the line. At the end of the pulse the tube 50 is restored by the aid of plate circuit condensers 65 in combination with the rest of the circuit elements.

Since the apparatus at station 2 is a duplicate of that at station 1, the action taking place in station 2 in receiving the waves sent out from station 1 in accordance with the foregoing description can be understood by considering that similar waves are being received in station 1 in which case all of the two-position switches 23, 24, 25, 27, 54 and 55 are assumed in their lower or receiving position.

Considering first the start impulse sent out from station 2, this is received through transformer 46, lower contact of spring 55 to input terminals of filter 60. It will be noted that condenser 48 is now in parallel with inductance 49 and forms part of the filter to separate the start pulse wave from the speech waves. The 2,000-cycle frequency wave is applied to the grid of tube 50 and renders the tube conducting, sending a large pulse of current through the winding of the tripping magnet 33 releasing brush 13. As long as the station in Fig. 2 continues to transmit, the cam 16 at such station sends out a start impulse once each revolution of the cam, which as stated rotates at a slightly lower speed than the distributor shaft. This causes the brush arm 13 at station 2 to be stopped momentarily once each revolution. The brush arm 13 at station 1, serving as the receiving station, if running in exact synchronism is stopped once each revolution on the short commutator segment 10 for the same length of time as the transmitting commutator brush or, if the receiving brush is running slow or fast by a slight amount, it is stopped for a shorter or longer length of time as the case may be. The use of the short segment in connection with the synchronizing of the transmitting and receiving distributors is disclosed and claimed in my copending application referred to.

The jumbled speech waves received from station 2 through switches 24 and 23 energize the winding of recording magnet 19 to make a record of the received waves on the tape 12. As this tape rotates past the various reproducer magnets 20, these latter pick up the recorded waves and transmit them through code switches 28 and 39 in boxes 37 and 38 and switch 27 to the segments of commutator 29 and the wiring and settings of the code switches are such that as the brush 13 passes over the commutator segments in succession the speech fragments are rearranged in their normal order in the coil 31, from which they are transmitted through switch 25 to receiver 18. A given setting of the knobs 28 and 39 will result in transmitting alternately in accordance with two independent codes and also in receiving in accordance with the same two codes. The knobs 28 and 39 in stations 1 and 2 are, therefore, given the same respective settings.

Reference will now be made to Fig. 2 which shows the wiring used between terminals 40 (Fig. 1) on the one hand and terminals 41 and 42 on the other hand, when the system is arranged for two independent codes as assumed in the foregoing description of Fig. 1.

In the upper part of Fig. 2 are shown the five code switches 28 of box 37. The five code switches 39 of box 38 are shown in the lower part of the figure. It will be noted that five conductors 43 are carried across from certain terminals of the code switches 39 to the upper section of transmit-receive switch 27 leading to commutator segments 1 to 5 and that five conductors 44 are carried across from switches 28 to the lower section of switch 27 leading to commutator segments 6 to 10. These conductors are indicated also in Fig. 1 as extending between the boxes 37 and 38. The nine terminals 40 are shown in the left central part of the Fig. 2 and are labelled *a* to *i* to indicate the reproducer magnets to which they are connected.

Taking the left-hand code switch 28 as typical, this comprises a shaft 65 carrying two wipers 67 and 68 insulated from each other. One end of wiper 67 sweeps over five contacts leading to certain of the terminals 40 and the other end of this wiper makes contact continuously with sector 66 leading via a conductor in group 44 and

transmitting contact of transmit-receive switch 27 to segment No. 6 of the commutator 29. This switch is therefore used in coding the speech for transmission. Wiper 68 at one end sweeps over five contacts leading to certain of terminals 40 and at its other end sweeps over five contacts leading over a group of conductors 74 to segments 1 to 5 of commutator 29 when transmit-receive switch 27 is in receiving position. This part of the code switch is used therefore in decoding the received jumbled speech. Each of the other code switches in box 37 is similar in construction, their sectors corresponding to 66 being distributed in rotation over conductors 44 to the next four commutator segments 7 to 10 through transmit contacts of switch 27, and the individual contacts of both switch sections being systematically distributed to terminals 40 and over conductors 74 to receiving contacts of switch 27, leading to segments 1 to 5. The same scheme of connection is used for the switches 39 in box 38.

In the operation of the circuit, one code can be set up on the switches in box 37 and an entirely different and unrelated code can be set up on the switches in box 38. When the gang switch 27 is thrown upward to talking position, the distributor will, in the first half of its revolution, send out the recorded speech from tape 12 in fragments in a jumbled order in accordance with the code set up on the switches in box 38 via upper portion of switch 27 leading to commutator segments 1 to 5. In the next half of its revolution it will send out speech fragments in a different jumbled order in accordance with the code set up on the switches in box 37, although, of course, the settings could be the same, if desired.

It should be noted in this connection that the reproducer magnets are connected to the commutator segments so that the speech which is being recorded on the tape while the brush arm is sweeping over commutator segments 1 to 5 is transmitted to line while the brush sweeps over segments 6 to 10. This entails a slight delay in transmission but it can be made a small fraction of a second, small enough not to interfere with carrying on a two-way conversation. The speech that is recorded in the second half revolution is, similarly, transmitted in the first half revolution. There is, of course, a corresponding small delay in receiving since the received message must be recorded before it is decoded. If the speech as recorded before being sent out is thought of as comprising portions 1,2,3,4,5 recorded in that order, this record occupies the length of tape up to reproducer *e*. If this was recorded in the second half revolution of the commutator, it can be sent out in some different order such as 5,4,1,3,2 by connecting reproducer *a* to segment 1, reproducer *c* to segment 2, reproducer *g* to segment 3, reproducer *f* to segment 4 and reproducer *h* to segment 5. This is done by setting code switches 39 of box 38 to the positions 5,4,1,3,2 in that order.

These will be received and recorded on the tape at station 2 in the order 5,4,1,3,2 and can be rearranged to normal order by connecting the reproducers to the successive commutator segments 6 to 10 at station 2 in the order *c,b,d,g,i*. It will be noted from Fig. 2 that when the code switches 39 are set to transmit the code 5,4,1,3,2 the receiving parts of the same switches are set to connect the reproducers to the commutator segments in the order just given so that the speech received in a given code is properly decoded. In other words, the knobs are set to the same positions at both transmitting and receiving stations.

A separate and independent code can be set up on switches 28 and this code will be sent out, as above stated, in the second half revolution of the commutator. Thus, if one code is set up on switches 28 and a different code is set up on switches 39, speech is sent out alternately in accordance with such codes. When the opposite station takes over and transmits to the first station the speech sent out from that station is coded in the same manner. The codes can be changed at any time according to previous arrangement between the parties or in accordance with information transmitted.

Fig. 3 represents a system in which the transmit-receive switch 27 is dispensed with and in which only the upper bank of code switches, 28, of Fig. 2, are used, the connections of Fig. 3 joining those of Fig. 2 along the line 3—3. The group of conductors 43 is omitted in this case. The two groups of five conductors from the left side of the code switches 28 are connected, one group to segments 1 to 5 and the other group to segments 6 to 10 of the commutator as shown in Fig. 3. This results in double coding but with each code the converse of the other, the two being, therefore, dependent rather than independent.

It was described above that if the code 5,4,1,3,2 is used to transmit, this is decoded by using in succession at the receiver the reproducers *c,b,d,g,i* in that order, which corresponds to a code 3,5,4,2,1. Similarly, if code 3,5,4,2,1 is sent, this is decoded by connecting the reproducers to decode in the order 5,4,1,3,2. It was pointed out that if knobs 28 are set for the code 5,4,1,3,2, arms 67 of the switches determine the sending of the speech fragments in that order and the wiring is such that arms 68 of these switches at the same time cause the reproducers to be connected to coil 31 in the order corresponding to code 3,5,4,2,1. Under these conditions, if the Fig. 3 circuit is used as a transmitter and the knobs 28 are set for code 5,4,1,3,2, this code is sent on segments 6 to 10 and the converse code 3,5,4,2,1 is sent on segments 1 to 5. At the receiver, the code 5,4,1,3,2 is decoded when the commutator brush is traveling over segments 1 to 5 and the code 3,5,4,2,1 is decoded in the next half revolution. The same operation takes place in transmitting in the opposite direction. For any other code set up on switches 28, it will be understood, this code is sent alternately with its converse code. In a limited number of cases, however, the sending code and its converse are identical as, for instance, the converse of code 5,4,3,2,1 is 5,4,3,2,1.

Fig. 4, when placed along side Fig. 2 at the line of division 4—4, shows a circuit for giving interlaced double coding. Commutator ring 29' is represented in this case as having twenty segments instead of the ten segments heretofore assumed. The two halves of the commutator are, for convenience of description, separated and partly straightened out. Opposite segments, as 1 and 11, etc. are connected together. The brush is supposed to sweep over the segments in the order 1 to 20 by a continuous counterclockwise motion and stop once each revolution as in Fig. 1. One segment, such as 20, is shortened for synchronizing purposes as described in connection with Fig. 1, this being the segment on which the brush is stopped.

Both banks of code switches of Fig. 2 are used in this case and two independent codes can be

set up on them. For illustration, let it be supposed that the code set up on switches **28** is 5,4,1,3,2 and the code set up on switches **39** is 2,1,5,4,3. It will be noted that the time taken for a point on the tape to move from one reproducer to the next is, in this case, equal to the travel time of the commutator brush over two segments. Tracing out the connections on Figs. 2 and 4, with switch **27** in transmitting (upper) position, the following speech fragments are sent in the order given, using the same notation as in the previous description.

Commutator times	Speech fragment sent
1	First half of 5th fragment.
2	Second half of 2nd fragment.
3	First half of 4th fragment.
4	Second half of 1st fragment.
5	First half of 1st fragment.
6	Second half of 5th fragment.
7	First half of 3rd fragment.
8	Second half of 4th fragment.
9	First half of 2nd fragment.
10	Second half of 3rd fragment.

In the commutator times 11 to 20 this action is repeated except that the next succeeding five fragments of speech are sent.

When switch **27** is in its receiving (lower) position, the speech fragments sent in the next previous half revolution from a distant transmitting station are decoded. Taking the fragments tabulated above, these are recorded on the tape in commutator times 1 to 10. In commutator time **11**, the first half of speech fragment 1 is reproduced since the middle code switch **28** is set in position 1 thus connecting commutator segment **11** in circuit with reproducer *c*. In commutator time **12**, the second half of speech fragment 1 is reproduced since the second switch **39** is set on contact **1** and connects segment **12** to reproducer *d*. Similarly the first half of fragment 2 is reproduced from *b* over fifth code switch **28** in position 2 and commutator segment **13**. Second half of speech fragment 2 is reproduced from *f* over the first code switch **39** in position **2** and commutator segment **14**. It will be clear from this how the remainder of the coded speech is decoded.

Fig. 5, when placed along side Fig. 2 at the line of division **5**—**5**, shows a circuit for giving interlaced converse coding. In this case the transmit-receive switch **27** is omitted, and the opposite sides of the commutator are not connected together as in Fig. 4 but are individually connected to the twenty conductors which make up the five-conductor groups **74**, **44**, **43**, **75**, in the manner shown. In this case both banks of code switches **28** and **39** of Fig. 2 are used. For example, if code 5,4,1,3,2 is set up on switches **28**, and code 2,1,5,4,3 is set upon on switches **39**, the order of sending, receiving and decoding will be evident from the following tabulation, in the light of the foregoing description.

In considering the following tabulations it should be borne in mind that the code 2,1,5,4,3 and its converse are the same, while the converse of the code 5,4,1,3,2 is the code 3,5,4,2,1. The wiring of the code switches is such (as heretofore explained) that when any code is set up on the code switches, e. g. those in box **37**, this code and its converse appear in the respective banks that are associated with these switches. In this figure, therefore, the code set up in one code switch box is sent in the first half revolution of the brush and its converse is sent in the second half. Interlaced with these in each half is the other code that is set up in the other code switch box alternating, in different half revolutions, with its converse. While for illustration the second of the two codes chosen and its converse happen to be the same, the operation is identical where the second code and its converse differ, as is the case in the first of the two codes chosen.

For segments 1 to 10 of sending machine and segments 11 to 20 of receiver

Send	Order of recording at receiver	Decoding order
		Recorded fragment:
First half of 5th fragment	1	No. 5=speech fragment 1_1.
Second half of 2nd fragment	2	No. 4=speech fragment 1_2.
First half of 4th fragment	3	No. 9=speech fragment 2_1.
Second half of 1st fragment	4	No. 2=speech fragment 2_2.
First half of 1st fragment	5	No. 7=speech fragment 3_1.
Second half of 5th fragment	6	No. 10=speech fragment 3_2.
First half of 3rd fragment	7	No. 3=speech fragment 4_1.
Second half of 4th fragment	8	No. 8=speech fragment 4_2.
First half of 2nd fragment	9	No. 1=speech fragment 5_1.
Second half of 3rd fragment	10	No. 6=speech fragment 5_2.

(It will be obvious that in the final column the number represents the speech fragment referred to in the original speech, and the subscript indicates which half of the fragment is involved.)

For segments 11 to 20 of sender and segments 1 to 10 of receiver

Send	Order of recording at receiver	Decoding order
		Recorded fragment:
First half of 3rd fragment	1	No. 9=speech fragment 1_1.
Second half of 2nd fragment	2	No. 4=speech fragment 1_2.
First half of 5th fragment	3	No. 7=speech fragment 2_1.
Second half of 1st fragment	4	No. 2=speech fragment 2_2.
First half of 4th fragment	5	No. 1=speech fragment 3_1.
Second half of 5th fragment	6	No. 10=speech fragment 3_2.
First half of 2nd fragment	7	No. 5=speech fragment 4_1.
Second half of 4th fragment	8	No. 8=speech fragment 4_2.
First half of 1st fragment	9	No. 3=speech fragment 5_1.
Second half of 3rd fragment	10	No. 6=speech fragment 5_2.

It will be clear that the multiple coding and interlaced multiple coding can be extended to more than the two codes specifically disclosed, provided the proper number of reproducing magnets properly spaced around the tape drum and the proper number of commutator segments be used together with the proper number of code switches. It should be noted that it is possible to drive the tape drum at some different speed than the brush by means of gearing if the spacing of the reproducing magnets would be made more practical. Taking the number 12, for example, which is divisible by 3 and by 4, if a four-element code be used, it may be interlaced three times, using seven reproducer magnets and twenty-four commutator segments. The twelve segments comprising one code length would then be divided among the three codes in the manner

$$A_1 B_1 C_1 \quad A_2 B_2 C_2 \quad A_3 B_3 C_3 \quad A_4 B_4 C_4$$

where the A's represent elements in code A, the B's elements in code B, etc. Twelve four-point code switches would be required.

A three-element code interlaced four times would take the form

$$A_1 B_1 C_1 D_1 \quad A_2 B_2 C_2 D_2 \quad A_3 B_3 C_3 D_3$$

and would require five reproducers, twenty-four commutator segments and twelve three-point code switches.

Still other code schemes may be built by following the principles illustrated in the various foregoing examples.

Although Fig. 1 shows only two stations, it will be observed that the apparatus at the two stations is or may be identically the same and that more than two stations can communicate with each other at one and the same time. At any one instant some one of the stations is transmitting and all of the other stations are receiving.

The invention is not to be construed as limited to the specific numbers or quantities or times mentioned nor to the details which have been disclosed, these all being given by way of illustration. The scope of the invention is defined in the claims, which follow.

What is claimed is:

1. The method of speech transmission with privacy comprising transmitting from a transmitting point speech waves occurring in successive time intervals divided into short segments of which the first N segments in each time interval are sent in successive time order different from their normal order of occurrence and in accordance with a preassigned code and the next N segments in each time interval are sent in accordance with a different code, and at a receiving point restoring the transmitting segments to their normal order to receive the message.

2. The method of speech transmission with privacy comprising transmitting from a transmitting point speech waves occurring in successive time intervals divided into short segments of which the first N segments in each time interval are sent in successive time order different from their normal order of occurrence and in accordance with a preassigned code and the next N segments in each time interval are sent in accordance with a different code, at a receiving point restoring the transmitting segments to their normal order to receive the message and simultaneously changing at least one of said codes from time to time at both transmitting and receiving points.

3. In speech privacy, means comprising a storage device and a rotary distributor for breaking message waves up into short fragments and transmitting said fragments in jumbled order, said distributor comprising a plurality of sets of segments operative in succession, and switching means connected to respective sets of said segments for transmitting said fragments in one jumbled order by one set of segments and the next succession of fragments in a different jumbled order by the next set of said segments.

4. In a speech privacy system, means to record speech on a suitable medium, means to reproduce the recorded speech in short segments and to transmit them ont of their normal order in accordance with a particular code, means to receive similarly coded speech and to record the same on a suitable medium, means to reproduce such latter recorded coded speech in short segments in proper decoding sequence to restore the received speech to understandable form, and means to transmit the coded speech segments first in said particular code and then in said decoding sequence, in alteration.

5. In a speech privacy system, means to break speech waves into fragments on a time basis and to transmit said fragments in a given jumbled order such that said transmitted fragments can be retranslated into understandable speech only by rearrangement of the order of the fragments to normal order, and means to increase the privacy comprising means to transmit said fragments alternately in said jumbled order and in an order corresponding to said rearrangement of said jumbled order.

6. In a speech privacy system, means to break speech waves into short fragments on a time basis and to transmit said fragments in abnormal order in repetitive manner according to a code such that when said transmitted fragments are reproduced in a converse order the speech is restored to understandable form, and means to increase the privacy comprising means to transmit said speech fragments in rapid alternation first according to said code and then in the converse order of said code.

7. A system according to claim 6 including switching means for changing the code at will.

8. In a speech privacy system, a speech recording medium, a succession of reproducers for reproducing the speech waves therefrom in the form of electrical waves, a rotary distributor having conductive elements connectible in succession into an outgoing path, and code switches connected between said reproducers and different sets of said conductive elements for determining a plurality of different coding schemes for the speech waves transmitted to said outgoing path in a single rotation of said distributor.

9. In a speech privacy system, means to break up speech waves existing in a certain small interval of time into several segments of correspondingly shorter duration, means to rearrange such segments in time order and to send them in the rearranged order, means to repeat this action indefinitely, and means to intersperse between successive repetitions of such sending out of speech segments the sending out of other speech segments rearranged in time in a different order.

10. A multiple code speech privacy system comprising means to subdivide speech waves representing a given message into short fragments on a time basis, cyclically operating means to transmit in each of N different equal times a number of such fragments in rearranged order within

each such time, such times being themselves separated by intervening time intervals, and means to transmit in each of such intervening time intervals a number of other such fragments of the same speech message in a different rearranged order.

11. In a speech privacy system, a speech wave recorder, pick-ups associated therewith to pick off different portions of the recorded speech wave, switching means to connect said pick-ups individually into a sending path in various orders to cause short fragments of speech to be sent into path out of their normal order to occurrence in speech, a plurality of separate determining means for said switching means each causing, when operative, a different order of sending of such fragments, and periodically operating means to render said determining means operative in rapid succession in recurring cycles.

12. A system according to claim 11, said recorder comprising a telegraphone tape, said switching means including a rotary distributor and said determining means comprising separate code switches interconnecting said pick-ups and said commutator.

13. In a speech privacy system, a continuously moving magnetic tape, a recording magnet and speech input for recording speech thereon, a plurality of reproducer magnets located along said tape, a line, a rotary distributor for connecting said reproducer magnets one at a time to said line, said distributor having a plurality of sectors each comprising a plurality of segments, and a plurality of multiposition switches individually connecting certain of said reproducer magnets to the segments of a respective one of said distributor sectors.

14. In speech privacy, means to record speech on a suitable medium, means to reproduce fragments of the recorded speech from the medium and transmit the reproduced fragments in abnormal time order, a set of code switches for determining the time order in which said fragments are sent, a second set of code switches for determining a different time order of sending of said speech fragments, and means for interlacing said two codes comprising means to send alternate fragments according to one code and intervening fragments in accordance with the other code.

15. In speech privacy, means to break up speech waves on a time basis into short fragments each of a small fraction of a second duration, means to transmit such fragments out of their normal order in accordance with one code, and means to interleave between the successive fragments other speech fragments in abnormal order in accordance with a different code.

16. In a speech privacy system, means for recording speech on a suitable medium, a plurality of reproducers spaced along the medium for reproducing the recorded speech, an output circuit, a rotary distributor for connecting selected ones of said reproducers to said output circuit for short intervals of time, code switches interposed between said reproducers and said distributor for selecting the reproducers to be connected to said output circuit and for determining the order of their connection to said output circuit, said code

switches comprising a plurality of groups, each group determining a different selection of said reproducers, and means causing said reproducers to be connected to said output circuit in accordance with the selection of each of said groups of code switches in each complete rotation of said distributor.

17. The method of speech privacy comprising dividing speech message waves on a time basis into short fragments, each fragment being so short as to be incapable of being understood, transmitting said fragments in groups in recurring time intervals, with the fragments composing each group rearranged among themselves in a particular time sequence, and interposing in each time interval, between said groups, other groups of fragments of the same speech message waves with the fragments of the latter groups rearranged among themselves in a different time sequence.

18. In a privacy system, means to record the message waves, a plurality of reproducers for reproducing the message waves from the record, a distributor having a first series of segments and a second series of segments, the second series being interleaved with the first series, a first code switch for connecting certain of said reproducers in irregular order to segments of the first series to provide for transmission of message wave fragments in a certain abnormal order, a second code switch for connecting certain of said reproducers to segments of said second series to provide for transmission of message wave fragments in a different abnormal order from the first, and means for connecting said distributor to a transmission channel.

19. In a privacy system, means comprising a storage element for effecting a delay in transmission, means comprising a cyclically operating distributor for breaking the message waves into fragments on a time basis, one code switching means interposed between said distributor and said storage means for variously interconnecting a portion of the segments of the distributor to points along the storage element to effect different amounts of delay in the transmission of the message fragments, and a second code switching means similarly interposed between said distributor and said storage means for variously interconnecting a different portion of the segments of the distributor to points along the storage element to effect different amounts of delay in the transmission of the message fragments, whereby the fragments may be transmitted in two different jumbled orders in one distributor cycle.

20. In a privacy system for message waves, cyclically operating timing means for breaking the message waves up into short fragments, means comprising a plurality of variable coding devices each determining an abnormal sequence of sending of said fragments, and means for setting up a different code on each of said devices for causing the message fragments to be sent out in two different abnormal sequences in the same cycle of operation of said timing means.

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